

are everywhere continuous with the plates of the perisoma, and either irregular and without suckers as in the *Spatangidæ* and *Echinoneus*, or partially ambulacral as in *Echinus* (the ten suckers round the mouth), or divided like the corona into inter-ambulacral and ambulacral plates with suckers, as in *Cidaris*. In the *Holothuriadæ* these plates upon the oral disc are absent, and the oral membrane in the *Ophiuridæ* also is naked.

[To be continued.]

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XIII.—Notes on the Ornithology of Ceylon, collected during an eight years' residence in the Island. By EDGAR LEOPOLD LAYARD, F.Z.S., C.M.E.S.

[Continued from vol. xii. p. 272.]

113. ORIOLUS MELANOCEPHALUS, Linn. *Ka-cooroolla*, Cing.; lit. Yellow Bird. *Mam-coel*, Mal.; lit. Mango Coel from its colour. Mango Bird and Golden Oriole of Europeans.

The Ceylon race of this common and widely distributed species differs from the Indian in having the tertiaries much less tipped with yellow; nor is this an accidental circumstance, but constant in every one of the many specimens I have examined. It may not be amiss to mention here that many of our island species differ in some degree from their continental brethren, though perhaps not sufficiently to constitute distinct races. Mr. Blyth, whose great experience in Indian ornithology enables him, perhaps better than most, to judge of these gradations of colour and size, early noticed the peculiarities of our fauna in our correspondence, and I cannot do better than give his own words on this subject\*. "Others," says he, "are doubtfully distinct, as *Megalaima zeylanica* from *M. caniceps* of S. India; *Leucocerca compressirostris* (J. A. S. B. xviii. 815) from *L. albofrontata*; and we might have here placed *Malacocercus striatus* as

to the posterior lip-like edge of the excavation. The anterior lip is not formed by the opposite edge of the shell, but by the plated buccal membrane.

\* The late lamented Mr. Strickland was so much struck with these differences, that at his request the publication of these "Notes" was suspended until we might together go over a series of Ceylon killed specimens and compare them with examples from India and the Indian Archipelago. I am not sorry for the delay, since it has enabled me to add several species new to the fauna of Ceylon which have been received from Mr. Thwaites of Peradenia within the last two months; but I have been deprived of the invaluable notes and remarks promised me, and which would have rendered these memoranda of much use to the naturalist, by the untimely death of my learned and accomplished friend.

doubtfully distinct from *M. Bengalensis*, *Dicrurus leucopygialis* from *D. cærulescens*, and *Pomatorhinus melanura* from *P. Horsfieldi*. *Corvus splendens* and *Acridotheres tristis* are of a much darker hue in Ceylon than in Bengal and N. India; so is *Micropternus gularis* of Ceylon as compared with the bird of S. India. *Hypsipetes Nilgiriensis* is on the contrary paler in Ceylon and more like the Himalayan *H. psaroides*. *Acrocephalus dumetorum* (xviii. 815) has in Ceylon a distinguishing greenish shade. The difference of *Palumbus Elphinstonii* of Ceylon from that of the Nilgiris has been already indicated: and lastly, *Oriolus melanocephalus* of Malabar and Ceylon may be constantly distinguished from that of Bengal, Nepal, Assam, &c. by the markings of the wings, as especially the quantity of yellow at the tips of the tertiaries; this being much more developed in the Bengal race, in which it occupies the whole outer web of the first and second tertiaries, and about  $\frac{3}{4}$  in. of the outer webs of the two next, whereas in the Ceylon and Malabar race it forms merely a series of small terminal spots to the tertiaries; the yellow tips of the coverts of the primaries are also constantly reduced in size in *O. melanocephalus* of Malabar and Ceylon\*.”

*O. melanocephalus* is very abundant in all parts of the island, and its glowing colouring adds much to the brilliancy of the eastern landscape; in my mind, palm trees, orioles, and white egrets are always associated with tropical scenery, and I often recall the delight I felt in my first shooting excursion in the swamps and paddy fields near Colombo, when orioles and other birds then new to me flitted from tree to tree before me. The note of the oriole is a clear, flute-like whistle, uttered on the wing as also when at rest: it is generally found in pairs, and is very partial to the jambo and other densely clothed trees.

#### 114. ORIOIUS INDICUS, Briss.

A single pair only of these birds fell under my notice: they were shot by a native at the back of the Bishop's residence near Colombo.

#### 115. CRINIGER ICTERICUS, Strickland.

Abounds in the mountain zone. I have not seen it elsewhere. Dr. Kelaart writes that it “is a common species in the low country;” he surely alludes to

116. PYCNONOTUS FLAVIRIATUS, Strickland. *Ca-cooroolla*, Cing., which is a very common species throughout the low country, and not uncommon in the hills. From its frequenting the cin-

\* See also his “Remarks on the modes of variation of nearly affined species or races of Birds chiefly inhabitants of India.”

namon gardens Europeans call it the "Cinnamon Thrush." It builds in low bushes, constructing a loose untidy-looking nest of fibres and grasses, in which it deposits four or five globose eggs of an earthy colour profusely freckled. The young are hatched about June; it has an abrupt mellow song.

117. *PYCNONOTUS PENICILLATUS*, Kelaart.

Discovered at Nuwera Elia by Dr. Kelaart, where he states it is "found in great abundance."

118. *PYCNONOTUS HÆMORRHAUS*, Gmel. *Kondacla*, Mal., and *Konda cooroolla*, Cing., from the resemblance of the top-knot of the bird to the knot in which the Cingalese and Tamils tie their hair, and which is called "*Kondeh*."

This bulbul is everywhere very abundant; it feeds on all kinds of insects, and builds a deep cup-shaped nest in bushes or trees. I saw one placed in the trellis-work of a verandah, close to the entrance of the house, through which the family continually passed and repassed. The birds sat unconcernedly on their eggs and hatched them. The eggs are—axis 10 lines, diam. 8 lines, and of a pale cream-colour, profusely blotched with darker markings, which are most frequent on the obtuse end.

119. *PYCNONOTUS ATRICAPILLUS*.

Syn. *Ægithina atricapilla*, Vieill.

Is common in the southern and central provinces. Its habits are those of the flycatcher, lying in wait and pouncing suddenly on its prey. I believe it breeds in low bushes, as I once found an unfinished nest which I feel sure belonged to this bird; a pair hovered about all the time I examined it. It was a loose structure of fibres and hair.

120. *HYPSPETES NILGHERRIENSIS*, Jerdon.

I have not seen this species lower than Avishavelly; there it appears scantily, and increases in numbers with the altitude, until it becomes one of the most common of the hill tribes. It always flies in small flocks and feeds on berries, which it culls either from the loftiest tree-tops far beyond gun-shot, or from the low bushes by the road-side.

121. *CYORNIS RUBECULOIDES*, Vigors.

I obtained a few specimens of this elegant little flycatcher during their migration from the main land. I first shot them on the 14th of October, 1851, and a few subsequently at Point Pedro; they then disappeared, and I saw no more of them.

## 122. HEMIPUS PICATUS, Sykes.

Rare, though widely distributed. I procured a specimen or two in Colombo near Jaffna; it frequents trees, and when seen is generally in small parties of four or five. The stomachs of those dissected proved full of small flies.

## 123. OCHROMELA NIGRORUFA, Jerdon ?

Among the drawings made by E. L. Mitford, Esq., of the birds which fell under his notice at Ratnapoora, was one which certainly represented this bird. He described it to me as migratory, appearing in June, and added that they fed much on spiders.

## 124. MYIAGRA CÆRULEA, Vieill.

This lovely little azure flycatcher is widely distributed, though Dr. Kelaart has not noticed it at Nuwera Elia. It generally hunts in small flocks, and at times I have heard it utter a short but pleasing song. I think it is migratory.

125. TCHITREA PARADISI, Linn. *Vāl cooroovi*, Mal.; lit. Tail Bird. *Ginihora*, Cing. (the Red Bird); lit. Fire Thief. *Raddehora*, Cing. (the White Bird); lit. Cotton Thief.

This "Bird of Paradise" of the Europeans is common in Ceylon. Nothing can exceed the gracefulness of the adult cock birds, when in full plumage they fly from tree to tree, their long tails fluttering in elegant undulations. I have often watched them, when seeking their insect prey, suddenly turn on their perch, and whisk their long tails with a jerk over the bough as if to protect them from injury. The white plumage is only assumed in the second year; the red tint apparently fades, leaving the feathers white, though the shaft turns black. I have a specimen shot in February in which this change is going on; most of the feathers have altered their hue, some more or less, others not at all. Certainly they migrate, but breed with us; the nest is a neat, well-built, cup-shaped structure, composed of mosses and lichens outwardly, and lined with hair and wool. I found one nearly completed in the fork of a satin-wood tree at Tangalle; the eggs I could never procure.

## 126. LEUCOCERCA COMPRESSIROSTRIS, Blyth.

Of this bird Mr. Blyth thus writes: "Like *L. albofrontata*, but with the bill much more compressed; perhaps a variety only."

I procured two at Tangalle, and a third in a little native village near Anarajahpoora. I shot them in tamarind trees. They secured their prey in the usual manner of flycatchers, and were

fearless birds, allowing me to approach and watch them closely for some time before I shot. I fancy those at Tangalle had a nest in the boughs of the tamarind, but though I searched closely I could not find it.

127. *CRYPTOLOPHA CINEREOCAPILLA*, Vicill.

I procured this bird in plenty at Ambegamoa in March. Dr. Kelaart found it at Nuwera Elia. I consider it as strictly a hill species. It frequents high trees in small parties, and darts at minute insects at rest on the leaves.

128. *BUTALIS LATIROSTRIS*, Raffles.

A migratory visitant, appearing in Colombo in October; it is very common and widely distributed. It likes to sit on the outside branches of trees, from which it darts on its insect prey like our English species.

129. *BUTALIS MUTTUI*, Layard.

Length 5 inches, of closed wing 3 inches, of tarsi nearly 7 lines, bill (to the end of gape)  $8\frac{1}{2}$  lines; upper mandible dark brown with pale tip, lower mandible yellowish. General resemblance of *But. latirostris*, but of a far more rufous colour; this colour most prevalent on the outer webs of the wing-primaries, the outer tail-coverts, and sides of the breast and belly. Throat, belly and vent white; breast rufous ashy; back of the head dark brown; irides light brown.

I name this new species after my old and attached servant Muttu, to whose patient perseverance and hunting skill I owe so many of my best birds. This one he brought in one morning at Pt. Pedro during the month of June: he described its habits as precisely similar to *B. latirostris*. As a specimen it is unique.

130. *STOPORALA MELANOPS*, Vigors.

Rare; only appearing in the hills. I procured it at Ambegamoa,—Dr. Kelaart at Nuwera Elia.

131. *PERICROCOTUS FLAMMEUS*.

Is common, inhabiting high jungle. It does not, however, extend further into the Northern province than Vavoniavlancolom, where it is entirely replaced by

132. *PERICROCOTUS PEREGRINUS*, Linn.,

which is however mingled with it in all localities. In habits these two species are similar, hunting about trees for small in-

sects and larvæ, but never descending to bushes. It always appears in flocks, and when one bird flies off to another tree, the whole party follow in succession.

### 133. CAMPEPHAGA MACEI, Less.

Found in the S. and W. provinces generally in pairs, but it is decidedly a rare bird. I know nothing of its habits save that it feeds on insects and utters a hoarse cackling note. I have observed it much on dead trees.

### 134. CAMPEPHAGA SYKESI, Strick.

Is far more common than the preceding, and extends over the whole island. Like *C. Macei* also it is only found in pairs, frequenting high trees and avoiding the neighbourhood of habitations; it feeds on insects. Irides dark hair-brown.

### 135. ARTAMUS FUSCUS, Vieill.

The "*wood-swallow*" is a widely distributed but local species, small parties being found in various parts of Ceylon. These parties generally consist of three or four families, each of which has its own tree. When the nestlings have left their cradle they may be seen sitting side by side on a branch, whilst the old birds fly off for insects and return to feed their offspring by turns. Even after the young birds can shift for themselves they keep up their gregarious habits, and return to their bough after each hunting excursion. Their fellows receive them open-mouthed, as if repelling the intrusion, but finally they all settle down in good fellowship. The flight of this species is very elegant; they soar upwards to a great height, and then sail down again in widening circles to the branch from which they started. They build a cup nest, composed of fibres and grasses, in the heads of cocoa-nut trees, on the base of the large fronds, but I never succeeded in getting the eggs.

### 136. EDOLIUS PARADISEUS, Linn.

I obtained this racket-tailed shrike in the jungles near Anarajapoorra, as detailed in a previous Number of this publication. Mr. Blyth makes the following observations upon it:—"The *Edolius* is also peculiar, and nearly resembles *E. Paradiseus* of the Malay countries, but has the frontal crest more developed, though much less so than in the *Edolii* we have seen from S. India."

This species seems confined to the jungles of the Wanny, and to frequent lofty trees, amid the boughs of which they sing very sweetly.

137. *DICRURUS MACROCERCUS*, Vieill.

I cannot help thinking that Dr. Kelaart has wrongly identified this species in his 'Prodrômus Faunæ Zeylanicæ,' for he writes—  
 "E. Malabaricus, or king crow, is seen in all parts, generally in pairs, in the open fields; they perch on the backs of cattle."

Surely he refers to *Dicrurus macrocercus*, which is the Colombo species, and much addicted to perching on cattle: this is also a habit of *D. longicaudatus*, one of the Jaffna species, and my old note upon it, which I copy verbatim, is curiously like Dr. Kelaart's own observation. I do not, however, think he ever saw *D. longicaudatus*, not having visited the Jaffna peninsula, to which it is confined, and not including it in his list; *D. macrocercus* therefore is probably the bird to which he alludes. Even this latter name is likely to be changed, for Mr. Blyth writes, after comparing a number of Ceylonese specimens with some of the Indian race, "The Cingalese small race is so constant in its characters, that it may bear the distinctive name of *D. minor*. The Javanese race is perfectly similar to that of India."

*D. minor* is common about Colombo, frequenting the natives' gardens; it feeds on insects, upon which it darts from a spray, to which it returns after each short excursion. They sing not unpleasingly, and often pour out a note of joy as they follow each other in rapid coursings through the trees.

138. *DICRURUS EDOLIFORMIS*, Blyth.

Not uncommon. I procured a few specimens during a short sojourn I made at Ambegamaoa; their habits were not different from those of the other *Dicruri*; they seem to keep entirely to the jungle. The species was first discovered by Dr. Templeton in 1847, and described by Mr. Blyth in J. A. S. xv. 297.

139. *DICRURUS LONGICAUDATUS*, A. Hay. *Erattoo valan coo-roovi*, Mal.; lit. Double-tailed Bird.

Common in the Jaffna peninsula, and extending as far as Anarajahpoora; it frequents open lands and perches on the backs of cattle to seek for ticks, on which it feeds largely. It usually goes in pairs and is fond of sitting on the "matties," of which the fences in the open country are generally composed. From these it sallies forth in quest of insects, which it captures either on the wing or in the grass, and I have often seen it *on the ground itself* seeking its food, a habit I never saw displayed by any of our other *Dicruri*. It has a hoarse unmusical note.

140. *DICRURUS CÆRULESCENS*, Linn.

I procured one or two specimens of this species at Pt. Pedro, but it probably is only an accidental visitor.

## 141. DICRURUS LEUCOPYGIALIS, Blyth.

A common species about Colombo. The European name for all these birds is "king crow," which seems to be derived from an inveterate habit they all have of chasing every crow from their vicinity. *D. leucopygialis* is very partial to the cocoa-nut tree, on the fronds of which it sits, pouring out a lively song, and battling with its fellows or some stray crow. When one of these latter comes in sight the king crow rushes down, screaming and darting upon his back; in vain the crow attempts to elude his persecutor by doubling and twisting among the branches. His enemy pertinaciously follows in pursuit, and by his cries attracts all within hearing, and the crow runs the gauntlet among them till out of his adversaries' dominions. I see Dr. Kelaart includes this species in his list, marked with an asterisk, denoting that he does so on the authority of Mr. Blyth. He must be acquainted with this bird, and has doubtless mistaken it for the *E. Remifer* of Temminck, which he has enumerated in his Catalogue, and which does not exist in the island.

## 142. IRENA PUELLA, Horsf.

Is very rare, but one specimen has fallen under my notice, and one is named by Dr. Kelaart; both were shot in the central province near Kandy.

## 143. LANIUS SUPERCILIOSUS, Linn.

Our bird is a variety, but not sufficiently distinct to constitute a species, being simply paler and wanting the rufous crown of the Indian bird. It is exceedingly abundant in all open lands dotted with small bushes. I saw them in greater numbers about Hambantotte than in any other part of Ceylon; they frequented low bushes.

## 144. LANIUS ERYTHRONOTUS, Vigors.

Is confined to the Jaffna peninsula, where they are not uncommon. They frequent the Euphorbia trees, building a cup-shaped nest composed of mosses and lichens lined with wool and hair; the young are fledged in June, but I was not so fortunate as to find the eggs. I never detected either of our indigenous "Butcher birds" fixing an insect on a thorn previous to devouring it; nor did I ever see an insect so impaled; yet the birds were very abundant in the N. Province, and even in my own compound, several pairs were constantly about. I am inclined to think that this habit is attributed to them without due investigation.



145. *TEPHRODORNIS AFFINIS*, Blyth.

Peculiar to Ceylon, where it affects wooded grass lands; it is not uncommon about Jaffna, Colombo and Kandy. It is migratory, and appears in October. The iris of this species is a greenish yellow.

[To be continued.]

XIV.—*On the Mechanism of Aquatic Respiration and on the Structure of the Organs of Breathing in Invertebrate Animals.*

By THOMAS WILLIAMS, M.D. Lond., Licentiate of the Royal College of Physicians, formerly Demonstrator on Structural Anatomy at Guy's Hospital, and now of Swansea.

[Continued from vol. xii. p. 408.]

*Articulata*.—The annulose are most naturally succeeded by the articulate classes. The word 'annulose' differs in signification not more from the word 'articulate,' than in structure the annulose differs from the articulate animal. In the former a mechanically perfect *joint* never occurs. An 'articulation,' complete in all its mechanical appliances, is not produced in the animal kingdom below the Myriapod. The feet and tentacles of the Annelid, the spines and hard appendages of the Echinoderm, the soft processes of the Medusan, and the feelers of the Zoophyte are equally remote in construction from the leg of the insect or the claw of the crab. A '*joint*' is the symbol of organic superiority: it is not an arbitrary symbol; it is a unit in an *assemblage* of signs which proclaim a new and higher combination in the arrangements which constitute 'life.' At this limit in the animal series, the fluids and the solids of the organism undergo a signal exaltation of standard. The system of the chylaqueous fluid exists no longer in the adult organism,—it is present only in the embryonic. It is supplanted by that of the blood-proper. This capital fact supplies the material wherewith the physiologist forges the golden key which is capable of unlocking treasures long hidden from the eye of science. Coincidentally with the *joint*, at the frontier of the articulate subkingdom, there occurs a heart to circulate the blood, fibrine, and with it an order of floating corpuscles more highly organized in the fluids; a wondrous development of the muscular apparatus, striæ in the muscle-cell, a rapid increase in the dimensions of the cephalic ganglia, and in those of the organs of the special senses. It is here, in the history of the reproductive system, that the dioecious character is first unquestionably assumed. These are note-worthy events in the ascensive march of organic architecture! *Why*, at